2003 DoD Maintenance Symposium & Exhibition: Transferring Technology to Improve Maintenance Processes

Update on National Center for Manufacturing Sciences (NCMS) and the Commercial Technologies for Maintenance Activities (CTMA) Program

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NCMS Collaboration that works.

Flow of Presentation

- Who is NCMS
- What is the CTMA Program
- Ongoing and Emerging Projects
- Process for New Projects
- How to Participate

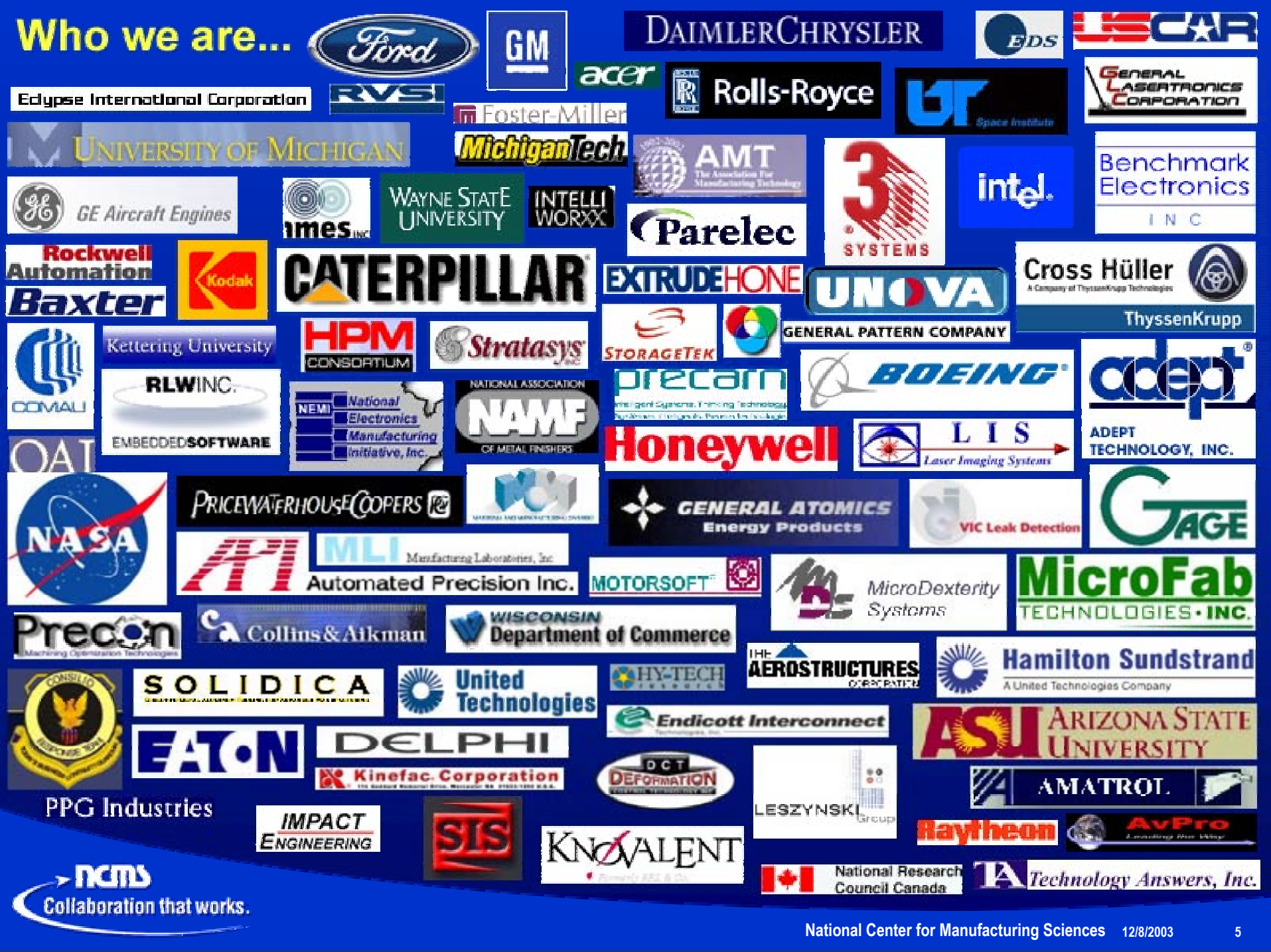
NCMS Mission

The NCMS mission is to build the global competitiveness of its manufacturing industry partners.

This is NCMS

- Organized under the National Cooperative Research Act of 1984; formed in 1986
- Largest cross-industry collaborative R&D consortium in North America
- Only consortial effort in the U.S. devoted exclusively to manufacturing technologies, process, and practices
- More than 17 years of experience in the formation and management of complex multi-partner collaborative R&D programs

Who we are...


Ford
GM
DaimlerChrysler
EDS
USCAR
Eclypse International Corporation
RVSI
acer
Rolls-Royce
UT Space Institute
General Lasertronics Corporation
Foster-Miller
University of Michigan
MichiganTech
AMT The Association For Manufacturing Technology
3D Systems
intel
Benchmark Electronics INC
GE Aircraft Engines
imes
Wayne State University
Intelli Worxx
Parelec
Rockwell Automation
Baxter
Kodak
CATERPILLAR
EXTRUDEHONE
UNOVA
Cross Hüller
ThyssenKrupp
COMAU
Kettering University
HPM Consortium
Stratasys
StorageTek
General Pattern Company
RLWINC
Embedded Software
National Electronics Manufacturing Initiative, Inc.
National Association of Metal Finishers
precam
BOEING
adept
ADEPT TECHNOLOGY, INC.
Honeywell
LIS Laser Imaging Systems
NASA
PricewaterhouseCoopers
General Atomics Energy Products
VIC Leak Detection
Gage
API
MLI Manufacturing Laboratories, Inc.
Automated Precision Inc.
MOTORSOFT
MicroDexterity Systems
MicroFab Technologies Inc.
Precon
Collins & Aikman
Wisconsin Department of Commerce
The Aerostructures Corporation
Hamilton Sundstrand
A United Technologies Company
SOLIDICA
United Technologies
HY-TECH research
Endicott Interconnect
Arizona State University
EATON
DELPHI
Kinefac Corporation
DCT Deformation
LESZYNSKI Group
AMATROL
PPG Industries
IMPACT Engineering
SIS
KNOVALENT
Raytheon
AvPro
National Research Council Canada
Technology Answers, Inc.
ncms
Collaboration that works.

We Deliver….

- Technology solutions
- Strategic partnerships
- Access to funding sources
- Neutrality
- Program management expertise
- Business practice solutions
- Knowledge capture & e-learning solutions
- Networking opportunities

Who we are- a full complement of program support capabilities

- Program Management
- Finance and Accounting
- Contract Administration
- Legal
- Communications & Public Relations
- Management Information Systems
- Electronic Collaboration

NCMS Program Areas

- Government Partnerships
  - Commercial Technologies for Maintenance Activities (CTMA)
  - Environmental projects with EPA
  - R&D Joint Ventures through NIST ATP
- Manufacturing Trust
- Knowledge Solutions Division

Commercial Technologies for Maintenance Activities (CTMA)

- Identify, form, launch and deploy new projects coupling the needs and strengths of commercial industry with the DoD's maintenance, repair and remanufacturing facilities
- Focus on reducing overall costs and increasing readiness
- Cooperative Agreement between NCMS and the Office of the Secretary of Defense
- DoD-industry co-funding on a 2:1 match basis
- http://ctma.ncms.org

DoD Participants

- Tobyhanna Army Depot (AD)
- Corpus Christi AD
- Red River AD
- Anniston AD
- Fort Richardson, Fort Wainwright

- Norfolk Naval Shipyard (NSY)
- Portsmouth NSY
- Pearl Harbor NSY
- Puget Sound NSY

- Marine Corps Maintenance Center Albany
- Marine Corps Maintenance Center Barstow

- Naval Air Depot North Island (NADEP)
- NADEP Jacksonville
- NADEP Cherry Point

- OC- Air Logistics Center (ALC)
- OO- Air Logistics Center (ALC)
- WR-ALC
- Elmendorf AFB

- Naval Submarine Base- Kings Bay
- Naval Submarine Base- Bangor

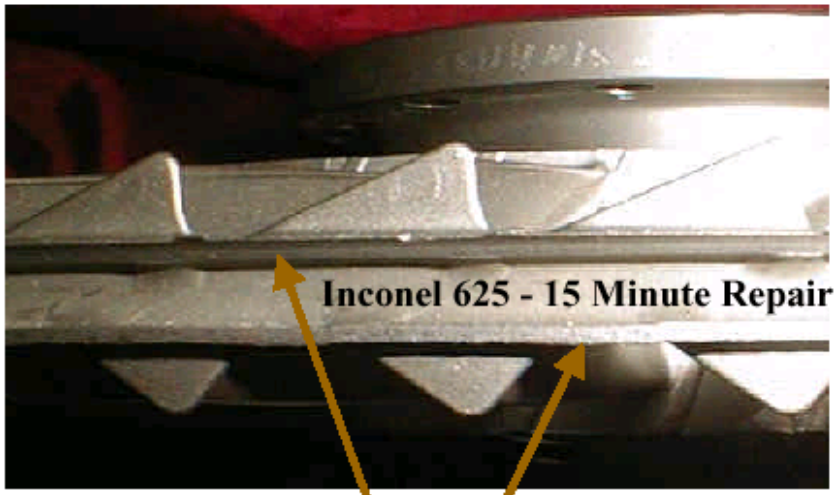
- Naval Undersea Warfare Center, Keyport
- Naval Surface Warfare Center, Crane

CTMA Ongoing Projects

- Isotropically Conductive Adhesives
- OptiCam/IPOMX
- Flat Wire Deposition Process
- Laser Decoating Process for Helicopter Blades
- Process Substitution for Composite Repairs
- Portable Thermal Spray Booth Equivalency Unit
- Laser Shot Peening for Life Cycle Increase
- Enhanced Wiring Integrity
- Next Generation Inspection Systems
- Maintenance Mentoring System
- Near Dry Machining of Aluminum
- Damage Wear Assessment of Rotating Equipment
- Laser Engineered Net Shaping
- Rapid Manufacturing and Repair
- High Throughput Production Processing
- Retrograde Part Identification Using 2nd Generation Permanent Marking Techniques
- E-Collaborative Maintenance
- High Density Chip-on-Board
- Alternative Air Pollution Control Systems
- LAV Life-Cycle Logistics Support Tool

As of October 2003

3rd Stage Turbine Rotor Repair



Area of Repair

.040”

Could not be repaired

Anniston Army Depot

Estimated Cost Savings

Inconel 625 - 15 Min

ITEM #1
Third (3rd) Stage Turbine Rotor

ITEM #2
Fourth (4th) Stage Turbine Rotor

ITEM #3
Second (2nd) Stage Nozzle

SS316 - 5 Min

ITEM #4
Compressor Stator 1st L.P.

LASER ENGINEERED NET SHAPING (LENS) - ESTIMATED PER YEAR COST SAVINGS

ITEM	PART	MATERIAL	PART NUMBER	NEW PART COST	ESTIMATED REPAIR COST	SAVINGS PER PART	PARTS REPAIRED PER YEAR	SAVINGS PER YEAR
1	Third (3rd) Stage Turbine Rotor	M3610C/Inconel 713LC	12271565	$ 8,297	$ 2,000	$ 6,297	230	$ 1,448,416
2	Fourth (4th) Stage Turbine Rotor	M3610C/Inconel 713LC	12281566	$ 5,485	$ 2,000	$ 3,485	230	$ 801,529
3	Second (2nd) Stage Nozzle	M3602/Inconel 713C	12286886	$ 6,032	$ 2,250	$ 3,782	600	$ 2,269,140
4	Compressor Stators (H.P. and L.P.)							
	1st L.P.	AMS 5510/321 Stainless	12302130	$ 810	$ 300	$ 510	175	$ 106,759
	2nd L.P.	AMS 5510/321 Stainless	12286[illegible]	$ 1,170	$ 300	$ 870	175	$ 152,264
	3rd L.P.	AMS 5510/321 Stainless	12286[illegible]	$ 610	$ 300	$ 310	175	$ 54,304
	4th L.P.	AMS 5510/321 Stainless	12286161	$ 611	$ 300	$ 311	175	$ 54,495
	5th L.P.	AMS 5510/321 Stainless	12302429	$ 701	$ 300	$ 401	175	$ 70,091
	1st H.P.	AMS 5504/410 Stainless	12286257	$ 604	$ 300	$ 304	175	$ 53,155
	2nd H.P.	AMS 5504/410 Stainless	12286261	$ 1,188	$ 300	$ 888	175	$ 155,377
	3rd H.P.	AMS 5504/410 Stainless	12286266	$ 575	$ 300	$ 275	175	$ 48,038
	4th H.P.	AMS 5504/410 Stainless	12286568	$ 1,893	$ 300	$ 1,593	175	$ 278,782
5	Fourth (4th) Stage Seal Runner	AMS 5662/Inconel 718	12286490	$ 319	$ 200	$ 119	600	$ 71,268
				$ 28,395	$ 9,150	$ 19,245		$ 5,563,617

Annual Cost Avoidance > $5 million

HiThru Initial Results

NC programming/machining times comparing new HiThru methods, with conventional methods.

Part Picture	Part Name	Programming Time		Machining Time			
		Conventional	HiThru	Conventional		HiThru	
	wr2005	80 to 120 hrs	7 hrs	no da		CinMach V5-2000	
						Set10	0:31
						Set 20	0:23
						Total	0:54
							(h:mm)
	sik05	45 to 75 hrs	10 to 20 hrs	Hermle 3-axis		CinMach V5-2000	
				Set10	0:46	Set10	0:47
				Set20	1:22	Set 20	0:22
				Set30	2:05	-	-
				Total	4:13	Total	1:09
	sik06	45 to 75 hrs	6 hrs	Makino 4-axis		CinMach V5-2000	
				Set10	0:14	Set10	0:36
				Set20	2:05	-	-
				Set30	0:03	-	-
				Total	2:32	Total	0:36
	sik09	45 to 75 hrs	12 to 19 hrs	Makino 4-axis		CinMach V5-2000	
				Set10	0:06	Set10	0:29
				Set20	1:06	Set 20	0:15
				Set30	0:04	-	-
				Total	1:18	Total	0:44

Programming Time Decreased by Two Weeks

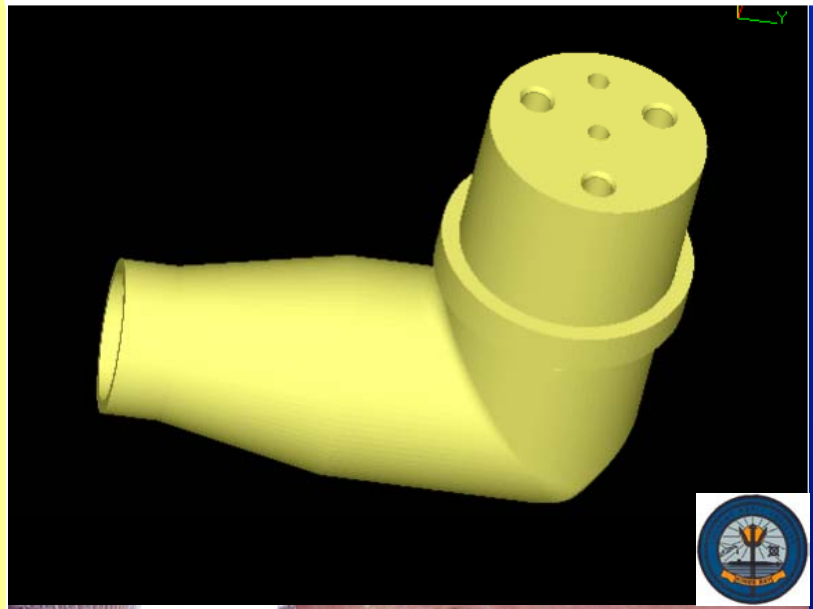
Rapid Prototyping Technology Advancement - $1,000,000/year Savings Potential
TRIDENT Submarine Tow-Point Cable Conn. (OK-542)

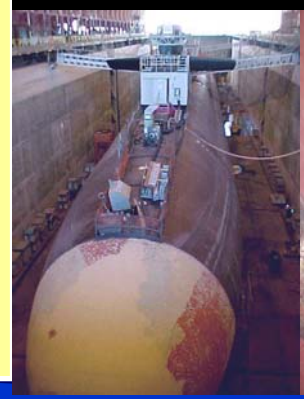
Problem/Challenge:

- Consistent failure of critical Tow Point Connector Cable due to design flaw and material degradation
- High cost and complexity to replace

Solutions/Results:

- NAWCWPNS and Pratt & Whitney teamed to deliver a rapid prototype tool in 14 days
- NAWCWPNS prepared an STL file from DOD's JEDMICS system
- Pratt & Whitney built the tool using the stereolithography process
- TRF created several injection mold prototypes with a variety of materials to find optimal solution





Emerging CTMA projects

- Rapid Manufacturing using Precision Metal Origami
- Coating Removal & Surface Prep
- Safety Line Track Manufacturing Process
- Inspection and Repair Preparation Cell for Radomes (IRPC)
- Six Sigma Product Quality
- Automated Test Equipment Test Program Set Migration System
- Automated Test Equipment - Synthetic Instrumentation Insertion
- Refurbishing and Extending Sealant Life
- Friction Stir Welding
- Selective Galvanizing by Cold-spray Deposition
- Heat Transfer Classification for Production Tooling and Composite Repairs

CTMA Project Launch Criteria

- Begins with a concept (~5 pages long)
- Joint Industry/DoD interest and needs
  - Hard deliverables, direct impact on manufacturing shop floor
- Cost/Benefits summary sketched out
  - Quantifiable
- Participant roles defined
- Letter of endorsement from base command
- Submission of concept to Pentagon (Office of Secretary of Defense)
- 10 day turnaround for approval…

Hurdles for New Project Ideas

- What new technology is being developed and implemented?
  - Not a mechanism for circumventing DoD procurement process.
- Is there cross-service involvement?
  - For broader dissemination of technology
- Is there sufficient industrial interest?
  - Greater than 2:1 cost share

Communications and Networking

- CTMA Website (http://ctma.ncms.org)
- The CTMA Connector Newsletter
- CTMA Working Symposium on Sustainment: "A Practical Roadmap to Manufacturing and Repair", Emory Conference Center Hotel, Atlanta, GA 30 March – 1 April

Thank You!

Questions?